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**HIGH CAPACITY BOBBIN WITH BUILT-IN BALL CONTROL HEAD AND
FOLDING SYSTEM**

OBJECT OF THE INVENTION

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The object of the present invention is related to a high capacity bobbin or spool with built-in ball or balloon control head and to a folding system for said spool, both having application in continuous ring spinning frames, ring twisting frames and ring twister-lap formers.

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BACKGROUND

At present, continuous ring spinning frames, ring twisting frames and ring twister-lap formers are limited in their capacity to twist or spin at high speeds due to the balloon effect. This effect causes the thread to wear down by friction against one or several surfaces called balloon control ring, making the thread fray and thus creating the necessity to increase the size of the traveller and lower production speed to eliminate the wearing or deterioration of the fibres that make up said thread or yarn.

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SUMMARY OF THE INVENTION

The high capacity spool with built-in balloon control head and folding system for said spool has been developed in order to eliminate the inconveniences of continuous spinning frames, ring twisting frames and twister-lap formers.

The high capacity spool with built-in balloon control head is composed of a spinning spool that is divided into three parts:

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- (1) a cylindrical-sectioned tube corresponding to the central part of the spool, around which spinning or twisting is carried out,
 - (2) a disc-shaped base or plate attached to the lower end of said tube, and
 - (3) a balloon control head closing off the top part of the central tube of the spool.

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The balloon control head includes a number of shoulders that can be various shapes (notches, blades, or other) and sizes, the number of which can vary depending on the material being processed, along the circumference of the balloon control head. These shoulders of the balloon control head are designed to pull the thread proceeding from a thread guide in a circular direction and lead it so that as it is pulled by the traveller, the twisting or spinning of the material is carried out as the material is still being held along the circumference of the central tube and is lowered spirally until it finally folds onto the spool, thus preventing the balloon effect and preventing the thread from wearing down by friction against the balloon control rings of the machine on which the spinning or twisting is being carried out. The shoulders of the control head and the traveller cause the thread or yarn tension to increase throughout the process until said tension becomes so high that, combined with the shape of the shoulder, it makes the thread jump up to be pulled by the next shoulder. As soon as the thread jumps, the tension decreases suddenly and later, while the thread is being pulled by another shoulder, the tension slowly increases again until the next jump comes about. The frequency these thread or yarn jumps to the following shoulder are carried out at depends on the amount and shape of the shoulders, the size of the thread or yarn, the traveller, and on the distance between the thread guide and the balloon control head. The distance between the thread guide and the head is adjustable so that appropriate tension can be maintained depending on the material to be spun or twisted.

The folding system includes a thread folding process with two stages. The first stage consists of making a cone of thread according to spool formation parameters: A, known as *spool advance*, and C for the vertical spool distance, known as *conical*. The lower part of the thread cone is wider than the upper part and is supported by the spool base, while the upper part of the cone is narrower than the lower part and is supported by the central tube of the spool. The purpose of this thread cone is to create a support base for the creation of a spool whose final format and appearance is that of the so-called bottle type, appropriate for any kind of material. During this stage, parameter C is variable until a constant value is achieved for vertical spooling, which depends on the number of layers needed on the spool, on the advance A set, and on the type of material to be twisted or spinned.

In the second stage of the folding process, the spooling is carried out with a constant vertical movement or spooling distance C. When the lever is raised, movement distance C is increased with advance A distance, so that a vertical ascending movement distance of $C + A$ is obtained. In vertical descending movement, the distance covered is C, so that the so-called bottle type appearance is achieved as a final effect of the sum of the two stages of folding, although the folding itself differs from the usual bottle fold, appropriate for any type of material since the control rings can be omitted as the thread follows the central tube of the spool so the main focus of friction is eliminated. This application also facilitates the elaboration of any type of thread with a traveller that has a lower mass in comparison to the ring balloon control system, which facilitates an increase in the production speed of the machine the spinning or twisting process is carried out on.

15 BRIEF DESCRIPTION OF THE DRAWINGS

A preferred embodiment of the high capacity spool with built-in balloon control head and the folding system, object of the present invention, is shown below for a better understanding of the object of the present invention, based on the attached drawings:

Figure 1: Front view of the high capacity spool with built-in balloon control head.

25 Figure 2: Detail of the high capacity spool with built-in balloon control head and of the thread guide with different balloon control heads.

Figure 3: Front view of The high capacity spool with built-in balloon control head after finishing spinning or twisting, with the bottle-type final format.

30 Figure 4: Portion of the bottle type format spool where the cone of thread made in the first stage is distinguished from the spinning or twisting carried out in the second stage of the folding system.

Figure 5: Front view of the high capacity spool with built-in balloon control head once bottle-type final format spinning or twisting is completed, in which the contour height of the different elements that make up the spool can be seen.

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Figure 6: Rendering of the folding system showing outline of how folding of the thread onto the spool is carried out in two stages with increasing C parameter.

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Figure 7: Rendering of the folding system showing outline of how folding of the thread onto the spool is carried out in two stages with decreasing C parameter.

15 **PREFERRED EMBODIMENT OF THE INVENTION**

The high capacity spool with built-in balloon control head is composed of a spinning spool that can be attached to continuous ring spinning frames, twister-lap folders and ring twisting frames, which include rings whose inner diameter varies between 35 and 600 millimetres. The high capacity spool with built-in balloon control head is composed of a spinning spool divided into three parts:

(a) a cylindrical-shaped tube (2), corresponding to the central part of the spool and around which spinning or twisting is carried out. This central tube (2) is preferably made of aluminium or plastic, and its dimensions vary according to the diameter of the machine it is to be installed in and the maximum folding height h (13) that the folding is carried out at, since the folding system requires an empty space h_1 (12) between the top of the thread spool (6) and the lower end of the balloon control head (1) in order to maintain the appropriate tension of the material to be processed. The values of the diameter d (11) of the central tube (2) are between (inner diameter of the ring (19) of the machine) / 5, and (inner diameter of the ring (19) of the machine) / 2. The height of the central tube (2) of the spool is the result of adding the maximum folding height h (13) set for folding the thread on the central tube of the spool (2), which is a variable height between 100 and 1500 millimetres, and the height of the empty space (9) h_1 (12). The value h_1 (12) of the empty space (9) is

between the values (ring diameter (19)) / 10, and (ring diameter (19)) * 1.5, and is determined according to the machine and the material to be spun or twisted.

(b) a base or plate (3) attached onto the lower end of the central tube (2), preferably disc-shaped and made of plastic or aluminium. Diameter D (14) of the base (3) is adjusted to the diameter of the ring (19) of the machine the spinning or twisting process is being carried out on. The value of diameter D (14) is lower by a value of between 5 and 40 millimetres than the inner diameter of the ring (19) of the machine the spinning or twisting process is being carried out on.

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(c) a balloon control head (1) that closes the upper part of the central tube (2) of the spool. The diameter d' (15) of the balloon control head (1) is at least the same as the diameter d (11) of the central tube (2) of the spool although it can be larger than the diameter d (11) of the central tube (2) of the spool by up to 100 mm, this dimension being determined by the type of material to be processed. The balloon control head (1) is preferably made of plastic or aluminium. The balloon control head (1) includes a number of regularly distributed shoulders (4) along the upper area of the circumference of the head (1). These shoulders (4) can have different designs (notches, blades or other) and sizes, and vary in number between 1 and 250, depending on the material to be processed and on the type of process to be carried out. These shoulders (4) on the balloon control head (1) are designed to circularly pull the thread (10) and direct it so that the folding or spinning of the material is carried out following along the circumference of the central tube (2) of the spool, preventing the balloon effect and preventing the thread from wearing down due to friction against the control ring system of the machine the process of spinning or twisting is being carried out on.

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The shoulders (4) of the balloon control head (1) and the traveller (20) make the tension of the thread (10) or yarn increase throughout the process until said tension is so high that, combined with the shape of the shoulder (4), it makes the thread (10) jump so as to be pulled by another shoulder (4). As soon as the thread (10) jumps, the tension decreases suddenly and later, as it is pulled by another shoulder, said tension starts to grow slowly until the next jump is reached. The frequency the thread (10) or yarn jumps to the following shoulder (4) are produced at depends on the number and shape of the shoulders (4), the size of the thread (10) or

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yarn, the traveller (20) and the distance between the thread guide (5) and the balloon control head (1).

The balloon control head (1) receives the thread (10) from a thread guide (5) with capacity for vertical movement, that is, following along the centre of the spool (1). This vertical movement maintains a distance between the thread guide (5) and the balloon control head (1) with values of between (inner diameter of the ring (19) of the machine) / 50, and (inner diameter of the ring (19) of the machine) / 2. This thread guide (5) facilitates, by way of its movement, obtaining and maintaining the appropriate tension of the thread (10) throughout the twisting process, as it constantly moves to the appropriate point in space for controlling said tension.

The folding system consists of the formation of a spool with a bottle-type final format (6) in two stages. The first stage (18) consists of the formation of a cone (7) of thread whose function is to support the second stage (8) of filling the spool up to a maximum height h (13) on the central tube (2) of between 100 and 1500 millimetres, according to the type of thread material to be processed and the desired capacity for the spinning or twisting process. This maximum height h (13) of the thread (19) makes a thread-free area (9) remain, whose height h_1 (12) is between (tube (2) diameter) / 10, and (tube (2) diameter) * 1.5. this h_1 high (13) thread-free area (9) is necessary for the folding system, since the thread (10), proceeding from the balloon control head (1), slides along the central tube (2) spirally in descendant direction to folded position.

Thread cone filling (7) is carried out by way of a fixed constant advance, parameter A or advance (17), whose value is fixed at between 0.001mm and 20 mm and a vertical movement, parameter C or conical (16), whose movement value is between 1mm and 1500mm. These parameters A (17) and C (16) are fixed according to the type of material to be spun or twisted and the number of layers planned on. The layers are determined by dividing parameter C or conical (16) by parameter A or advance (17), so the final number of layers depends on the latter parameter. This value varies for the creation of a cone of thread (7) according to the type of material to be spun or twisted.

When filling the thread cone (7), the layer arranging method can be preferably carried out two ways, according to the variation given to parameter C or conical (16). This variation of parameter C (16) starts at a height of 0 mm and increases to the set maximum vertical movement value, increasing little by little as advance is carried out, whose distance is determined by parameter A or advance (17) of the spool, or else on the contrary, starting from the maximum vertical movement height fixed for parameter C (16) at a height of 0mm while a descending advance is carried out on the spooling fixed for parameter A (17), depending on the number of layers needed.

Having made the thread cone (7), the second stage (8) of filling is carried out. In this stage, filling consists of maintaining the vertical movement set at parameter C (16), but as the lever is raised, it is raised vertically by a distance equivalent to the sum of the values of parameter A or advance (17) and C or conical (16). During the descending movement, the lever only descends by the vertical movement preset for parameter C or conical (16). This process is repeated until the set maximum height h (13) is reached and the spool is completed, and the ring (19) lowers down to position 0 to end the cycle. The number of layers included in the second stage (8) is given by the relation (maximum height h (13)-vertical movement given by parameter C (16)) / (advance given by parameter A (17)). Both stages are consecutive in time. The final format obtained with this folding system is the bottle-type format, appropriate for spinning or twisting any kind of material.

Having sufficiently described the nature of the present invention, as well as a method for putting it into practice, we only need add that changes in form, materials and disposition may be introduced as long as said variations do not substantially alter the characteristics of the invention claimed.